chamber, after said first voltage changing process, said second voltage changing process, and said third voltage changing process,

wherein a voltage changing time $t_4$ during said fourth voltage changing process is set as follows relative to the resonance frequency $T_c$ of the pressure wave generated in said pressure generating chamber:

$0 < t_4 < T_c/2$;

wherein a time interval between a start time of said second voltage changing process and a start time of said fourth voltage changing process is set substantially half the length of the resonance frequency $T_c$ of the pressure wave generated in said pressure generating chamber.- -

## REMARKS

Applicant concurrently files herewith a Petition and fee for a One-month Extension of Time. An Excess Claim Fee Payment letter and fee for an excess independent claim is attached hereto.

This Amendment cancels claims 1-17 and adds new claims 18-22. Claims 18-22 are pending. Claims 18-22 are independent.

Attached hereto is a marked-up version of the changes made to the claims by the current Amendment. The attached page is captioned "**Version with markings to show changes made.**" It is noted that the amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicants also note that, notwithstanding any claim amendments herein or later during prosecution, that Applicant's intent is to encompass equivalents of all claim elements.

Applicant thanks Examiner Nguyen for indicating that claims 7 and 14-17 would be allowable if rewritten into independent form including all of the limitations of the base claim and any intervening claims. In this regard, this Amendment adds new claims 18-22 which correspond to allowable claims 7, 14-17. Applicant respectfully submits that claims 18-22 are allowable.

In view of the foregoing amendments and remarks, Applicant respectfully submits that the Application is in condition for allowance. Applicant respectfully requests prompt reconsideration and allowance.

Should the Examiner believe that anything further is desirable to place the Application into condition for allowance, Applicant invites the Examiner to contact the undersigned attorney at the telephone number listed below.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 8/29/02

James E. Howard
Registration No. 39,715

**McGinn & Gibb, PLLC**
8321 Old Courthouse Rd., Suite 200
Vienna, Virginia 22182
(703) 761-4100
**Customer No. 21254**

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**In the claims:**

**Please cancel claims 1-17 without prejudice or disclaimer.**

**Please add new claims 18-22 as follows:**

- - 18. (Newly Added) A method for driving an ink jet recording head, comprising

applying a driving voltage to an electro-mechanical converter to deform the electro-mechanical converter to thereby change a pressure in the pressure generating chamber filled with ink, thus ejecting ink droplets through a nozzle in communication with the pressure generating chamber, wherein said applying said driving voltage comprises:

at least a first voltage changing process for applying a voltage in a direction that increases a volume of said pressure generating chamber;

a second voltage changing process for then applying a voltage in a direction that reduces the volume of said pressure generating chamber; and

a third voltage changing process for applying a voltage in a direction that increases the volume of said pressure generating chamber again;

setting voltage changing times $t_2$ and $t_3$ during the second and third voltage changing processes so as to have such lengths as shown below, relative to a resonance frequency $T_c$ of a pressure wave generated in the pressure generating chamber:

$0 < t_2 < T_c/2$

$0 < t_3 < T_c/2$; and

providing said nozzle with an about 20 to about 40 $\mu$m opening diameter to eject said ink droplets in a size of about 5 to about 25 $\mu$m size.- -

- - 19. (Newly Added) A method for driving an ink jet recording head, comprising:

applying a driving voltage to an electro-mechanical converter to deform the electro-mechanical converter to thereby change a pressure in the pressure generating chamber filled with ink, thus ejecting ink droplets through a nozzle in communication with the pressure generating chamber, wherein said applying of said driving voltage comprises:

at least a first voltage changing process for applying a voltage in a direction that increases a volume of said pressure generating chamber;

a second voltage changing process for then applying a voltage in a direction that reduces the volume of said pressure generating chamber;

a third voltage changing process for applying a voltage in a direction that increases the volume of said pressure generating chamber again; and

setting voltage changing times $t_2$ and $t_3$ during the second and third voltage changing processes are set to have such lengths as shown below, relative to a resonance frequency $T_c$ of a pressure wave generated in the pressure generating chamber:

$0 < t_2 < T_c/2$

$0 < t_3 < T_c/2$; and

providing said nozzle with an about 20 to about 40 $\mu$m opening diameters to eject said ink droplets in a size of about 5 to about 25 $\mu$m size, wherein a start time of said third

voltage changing process is about the same as an end time of said second voltage changing process.- -

- - 20. (Newly Added) A method for driving an ink jet recording head, comprising applying a driving voltage to an electro-mechanical converter to deform the electro-mechanical converter to thereby change a pressure in the pressure generating chamber filled with ink, thus ejecting ink droplets through a nozzle in communication with the pressure generating chamber, wherein said applying said driving voltage comprises:

at least a first voltage changing process for applying a voltage in a direction that increases a volume of said pressure generating chamber;

a second voltage changing process for then applying a voltage in a direction that reduces the volume of said pressure generating chamber; and

a third voltage changing process for applying a voltage in a direction that increases the volume of said pressure generating chamber again;

a fourth voltage changing process for applying voltage in a direction that reduces the voltage of said pressure generating chamber, after said first voltage changing process, said second voltage changing process, and said third voltage changing process;

setting voltage changing times $t_2$ and $t_3$ during the second and third voltage changing processes so as to have such lengths as shown below, relative to a resonance frequency $T_c$ of a pressure wave generated in the pressure generating chamber:

$$0 < t_2 < T_c/2$$

$0 < t_3 < T_c/2$; and

providing said nozzle with an about 20 to about 40 $\mu$m opening diameter to eject said ink droplets in a size of about 5 to about 25 $\mu$m size.- -

- - 21. (Newly Added) A method for driving an ink jet recording head comprising:

applying a driving voltage to an electro-mechanical converter to deform the electro-mechanical converter to thereby change a pressure in the pressure generating chamber filled with ink, thus ejecting ink droplets through a nozzle in communication with the pressure generating chamber, wherein said applying said driving voltage comprises:

at least a first voltage changing process for applying a voltage in a direction that increases a volume of said pressure generating chamber;

a second voltage changing process for then applying a voltage in a direction that reduces the volume of said pressure generating chamber; and

a third voltage changing process for applying a voltage in a direction that increases the volume of said pressure generating chamber again;

setting voltage changing times $t_2$ and $t_3$ during the second and third voltage changing processes are set to have such lengths as shown below, relative to a resonance frequency $T_c$ of a pressure wave generated in the pressure generating chamber:

$0 < t_2 < T_c/2$

$0 < t_3 < T_c/2$; and

providing said a nozzle with an about 20 to about 40 $\mu$m opening diameter to eject

said ink droplets in a size of about 5 to about 25 $\mu$m size,

wherein the voltage waveform of said driving voltage includes a fourth voltage changing process for applying a voltage in a direction that reduces the volume of said pressure generating chamber, after said first voltage changing process, said second voltage changing process, and said third voltage changing process,

wherein a voltage changing time $t_4$ during said fourth voltage changing process is set as follows relative to the resonance frequency $T_c$ of the pressure wave generated in said pressure generating chamber:

$0 < t_4 < T_c/2$.- -

- - 22. (Newly Added) A method for driving an ink jet recording head comprising:

applying a driving voltage to an electro-mechanical converter to deform the electro-mechanical converter to thereby change a pressure in the pressure generating chamber filled with ink, thus ejecting ink droplets through a nozzle in communication with the pressure generating chamber, wherein said applying said driving voltage comprises:

at least a first voltage changing process for applying a voltage in a direction that increases a volume of said pressure generating chamber;

a second voltage changing process for then applying a voltage in a direction that reduces the volume of said pressure generating chamber; and

a third voltage changing process for applying a voltage in a direction that increases the volume of said pressure generating chamber again;

voltage changing times $t_2$ and $t_3$ during the second and third voltage changing processes

are set to have such lengths as shown below, relative to a resonance frequency $T_c$ of a pressure wave generated in the pressure generating chamber:

$0 < t_2 < T_c/2$

$0 < t_3 < T_c/2$; and

providing said a nozzle with an about 20 to about 40 $\mu$m opening diameter to eject said ink droplets in a size of about 5 to about 25 $\mu$m size,

wherein the voltage waveform of said driving volume includes a fourth voltage changing process for applying a voltage in a direction that reduces the volume of said pressure generating chamber, after said first voltage changing process, said second voltage changing process, and said third voltage changing process,

wherein a voltage changing time $t_4$ during said fourth voltage changing process is set as follows relative to the resonance frequency $T_c$ of the pressure wave generated in said pressure generating chamber:

$0 < t_4 < T_c/2$;

wherein a time interval between a start time of said second voltage changing process and a start time of said fourth voltage changing process is set substantially half the length of the resonance frequency $T_c$ of the pressure wave generated in said pressure generating chamber.- -

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**In re Application of**

Masakazu Okuda

**Serial No.:** 09/807,823 **Group Art Unit:** 2853

**Filed:** April 19, 2001 **Examiner:** Nguyen, Lam S.

**For:** METHOD FOR DRIVING INK JET RECORDING HEAD

Honorable Assistant Commissioner of Patents
Washington, D.C. 20231

## EXCESS CLAIM FEE PAYMENT LETTER

Sir:

Transmitted herewith is an amendment in the above-identified application. The fee has been calculated and is transmitted as shown below.

| | AFTER AMENDMENT | PREV. PAID FOR | EXTRA CLAIMS PRESENT | RATE | FEE DUE |
|---|---|---|---|---|---|
| Total Claims | 5 - | 20 | = 0 | x $18.00 | $ 0.00 |
| Indep. Claims | 5 - | 3 | = 2 | x $84.00 | $ 168.00 |
| **TOTAL ADDITIONAL FEE FOR THIS AMENDMENT** | | | | | **$ 168.00** |

The excess claim fee of $168 is included in the total fee for filing. A duplicate copy of this sheet is enclosed. The Commissioner is authorized charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 8/29/02

James E. Howard
Registration No. 39,715

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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**In re Application of**

Masakazu Okuda

**Serial No.:** 09/807,823 **Group Art Unit:** 2853

**Filed:** April 19, 2001 **Examiner:** Nguyen, Lam S.

**For:** METHOD FOR DRIVING INK JET RECORDING HEAD

Honorable Assistant Commissioner of Patents
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| | AFTER AMENDMENT | PREV. PAID FOR | EXTRA CLAIMS PRESENT | RATE | FEE DUE |
|---|---|---|---|---|---|
| Total Claims | 5 - | 20 | = 0 | x $18.00 | $ 0.00 |
| Indep. Claims | 5 - | 3 | = 2 | x $84.00 | $ 168.00 |
| **TOTAL ADDITIONAL FEE FOR THIS AMENDMENT** | | | | | **$ 168.00** |

The excess claim fee of $168 is included in the total fee for filing. A duplicate copy of this sheet is enclosed. The Commissioner is authorized charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 8/29/02

James E. Howard
Registration No. 39,715

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